

1 **AMENDMENTS TO THE CLAIMS**

1 1. (currently amended) An apparatus, comprising:

2 a monolithic device, the monolithic device comprising;

3 a first CMOS imaging array; and

4 a dark current monitoring device integrated with the first CMOS imaging array, the dark
5 current monitoring device monitoring the dark current during the time that the
6 first CMOS imaging array is receiving an image; and

7 a means for recording of ~~offset~~ signals O_i ; the ~~offset~~ offset signals O_i recorded by
8 exposing the first CMOS image array for a time t_s , where t_s is a short enough
9 time that dark current signals and projected light produced signals are small
10 compared to offset signals in pixels of the first CMOS array.

1 2. (original) The apparatus of claim 1, where the monolithic device consists of a single
2 semiconductor chip comprising a silicon substrate with integrated circuitry integrated
3 with a surface of the silicon substrate.

1 3. (original) The apparatus of claim 1, where the monolithic device consists of a single
2 semiconductor chip comprising a substrate with integrated circuitry integrated with a
3 surface of the substrate comprising silicon germanium material.

1 4. (original) The apparatus of claim 1, where the dark current monitoring device is at least one
2 semiconductor light sensor integrated with the monolithic device having a means attached
3 to the monolithic device to prevent light from activating the semiconductor light sensor.

1 5. (original) The apparatus of claim 4, where multiple semiconductor light sensors are used to
2 determine dark current variation over the monolithic device.

1 6. (original) The apparatus of claim 4, where the at least one semiconductor light sensor is a
2 second CMOS imaging array.

1 7. (original) The apparatus of claim 6, where multiple CMOS imaging arrays are used to
2 determine dark current variation over the monolithic device.

1 8. (original) The apparatus of claim 1, where the dark current monitoring device comprises;
2 at least one temperature monitoring device for monitoring temperature of the monolithic device,
3 and;
4 associated circuitry to determine dark current from the monitored temperature.

1 9. (original) The apparatus of claim 8, where multiple temperature monitoring devices are used
2 to determine dark current variation over the monolithic device.

1 10. (original) The apparatus of claim 8, where the at least one temperature monitoring device
2 is a PTAT circuit integrated with the monolithic device.

1 11. (original) The apparatus of claim 8, where the at least one temperature monitoring device
2 is a device monitoring the voltage drop across a P-N diode junction having a constant
3 current.

1 12. (original) The apparatus of claim 8, where the associated circuitry is integrated with the
2 monolithic device to determine dark current from the monitored temperature

1 13. (original) The apparatus of claim 1, further comprising;

2 a stored record of dark current from each pixel of the first CMOS image array, measured
3 previous to the time that the first CMOS image array receiving the image;

4 associated circuitry using the stored record and the monitored dark current to correct the output
5 of each pixel of the first CMOS image array.

1 14. (original) The apparatus of claim 13, where the stored record and the associated circuitry
2 using the stored record are integrated with the monolithic device.

1 15-21 (canceled)

1 22. (previously presented) A method of recording an image of an object using light reflected or
2 transilluminated from the object, comprising;

3 a) forming an image of the object on a first CMOS image array by projecting the light reflected or
4 transilluminated from the object on to the first CMOS image array, the first CMOS
5 image array formed on a monolithic semiconductor substrate; and

6 b) monitoring the dark current of the first CMOS image array with at least one dark current
7 monitoring device integrated with the first CMOS imaging array on the monolithic
8 semiconductor substrate, the monitoring of the dark current concurrent with the forming
9 of the image;

10 c) exposing the first CMOS image array for a time t_s , where t_s is a short enough time that dark
11 current and projected light produce signals small compared to offset signals in pixels of
12 the first CMOS array; and then

- 13 d) recording the offset signals O_i , measured as a result of exposure for time t_i ; and then
- 14 e) subtracting O_i from signals produced by the first CMOS image array when exposure times are long enough that dark current signals are not small compared with O_i .

1 23. (previously presented) The method of claim 22, wherein the dark current signals of step c)

2 are produced from an unilluminated first CMOS image array, and further comprising;

3 f) recording signals $S_i = G_i (f_i(T, t))$ which result from step e).

1 24. (previously presented) The method of claim 23, further comprising;

2 g) projecting light from a uniformly reflecting extended object on to the first CMOS array, the

3 light intensity high enough that dark current signals are small compared to signals produced by

4 the light illumination; and

5 h) recording signals $S_i = G_i (k_i I_i R_i QE_i) + O_i$ from the first CMOS array produced by light

6 projected from the uniformly reflecting object; then

7 i) subtracting O_i from the results of step f);

j) recording an effective gain coefficient $G_i^* = G_i (k_i I_i QE_i)$.

1 25. (previously presented) The method of claim 24, wherein;

2 the step of forming an image of the object comprises recording signals

3 $S_i = G_i^* R_i + O_i + G_i f_i(T, t)$ from the first CMOS array; further comprising;

4 k) correcting the recorded values S_i to calculate $G_i f_i(T, t)$, wherein the results of the step of

5 monitoring the dark current are used to correct the recorded values S_d ; and

6 1) calculating R_i from the known values of S_i , G_i^* , O_i and $G_i f(T, t)$.

1 26. (amended) A system, comprising:

2 a monolithic device, the monolithic device comprising:

3 a first CMOS imaging array; and

4 a dark current monitoring device integrated with the first CMOS imaging array, the dark
5 current monitoring device monitoring dark current concurrently with the recording of an image
6 by the first CMOS imaging array;

7 a means for recording of offset signals O_i ; ~~the offset~~ offset signals O_i recorded by exposing
8 the first CMOS image array for a time t_i , where t_i is a short enough time that dark
9 current signals and projected light produced signals are small compared to offset signals
10 in pixels of the first CMOS array;

11 an optical system for imaging light reflected or transilluminated from an object on to the first
12 CMOS imaging array; and

13
14 circuitry for correcting the output from the first monolithic CMOS image array to account for the
15 dark current monitored by the dark current monitoring device.

1 27. (original) The system of claim 26, further comprising a storage device for storing the
2 corrected output.

1 28. (original) The system of claim 27, further comprising a display device for displaying the
2 corrected output.

1 29. (original) The system of claim 26, wherein the circuitry for correcting the output is
2 integrated on the monolithic device.

1 30. (Previously presented) The method of claim 22, further comprising;
2 recording an output from the first monolithic CMOS image array; and
3 correcting the output from the first monolithic CMOS image array to account for the dark current
4 monitored by the at least one dark current monitoring device.

1 31. (Previously presented) The method of claim 30, wherein the step of correcting comprises;
2 recording (a) an output of the at least one dark current monitoring device and (b) the dark current
3 output from each pixel of the unilluminated first CMOS image array in a different step
4 than the step of forming the image;

5 calculating the dark current contribution at each pixel during the forming of the image on the
6 basis of the dark current monitored concurrently with forming the image; and

7 subtracting the dark current contribution at each pixel from the output of the first monolithic
8 CMOS image array.

1 32. (Previously presented) The method of claim 30, wherein the step of correcting is
2 performed by circuitry integrated on the monolithic semiconductor substrate.

1 33. (Previously presented) The method of claim 22, wherein the step of monitoring the dark

2 current comprises;
3 monitoring the temperature of the first monolithic CMOS imaging array with at least one
4 temperature monitoring device integrated with the first monolithic CMOS imaging array;
5 and
6 calculating the dark current from the monitored temperature.
7

8 34. (Previously presented) The method of claim 33, wherein the step of monitoring temperature
9 comprises;
10 monitoring the temperature at a plurality of locations on the monolithic semiconductor substrate;
11 and
12 calculating the temperature variation over the first CMOS image array during the forming of the
13 image.

1 35. (Previously presented) The method of claim 22, wherein the step of monitoring the dark
2 current comprises;
3 monitoring the dark current at a plurality of locations on the monolithic semiconductor substrate;
4 and
5 calculating the variation of dark current over the first CMOS image array during the forming of
6 an image of the object.